

I. Input Device Functionality

1. Touch Gestures

[0135] A hand-held electronic device may be designed to recognize touch gestures applied to a touch screen and/or touch sensitive surface of the housing and thereby control aspects of the hand-held electronic device. Gestures are a stylized interaction with an input device that is mapped to one or more specific computing operations. The gestures may be made through various hand and finger motions. Gestures generally comprise a contact chord e.g., one or more fingers, and a motion associated with the chord. Alternatively or additionally, the gestures may be made with a stylus. In all of these cases, the input device i.e., touch screen and/or touch sensitive surface) receive the gestures and a controller of the hand-held electronic device executes instructions to carry out operations associated with the gestures. The hand-held electronic device may include a touch gesture operational program, which may be part of the operating system or a separate application. The gesture operation program generally includes a set of instructions that recognizes the occurrence of gestures and informs one or more software agents of the gestures and/or what action(s) to take in response to the gestures. For example, gestures that can be used are disclosed in greater detail in U.S. patent application Ser. No. 10/903,964, titled "Gestures for Touch Sensitive Input Devices," filed on Jul. 30, 2004, and U.S. patent application Ser. No. 11/038,590, titled "Mode-Based Graphical User Interfaces for Touch Sensitive Input Devices," filed on Jan. 18, 2005.

2. 3-D Spatial Gestures

[0136] In accordance with one embodiment, the hand-held electronic device may be designed to recognize 3-D spatial gestures measured by an accelerometer and to control aspects of the hand-held electronic device based on the 3-D spatial gestures. Spatial gestures are stylized motions of the device itself that are mapped to one or more specific computing operations. The 3-D spatial gestures may be made through various hand and arm motions, such as for example shaking, waving and the like. The accelerometer measures the motion related to the 3-D spatial gestures and a controller recognizes the motion as a 3-D spatial gesture and thereafter executes instructions to carry out operations associated with the 3-D spatial gestures. The hand-held electronic device may include a 3-D spatial gesture operational program, which may be part of the operating system or a separate application. The gesture operation program generally includes a set of instructions that recognizes the occurrence of gestures and informs one or more software agents of the gestures and/or what action(s) to take in response to the gestures.

[0137] One exemplary 3-D gesture is shaking the device. Shaking can cause the hand-held device causes the device to shift between modes or states. Alternatively, shaking the hand-held device can cause a selection event to occur. For example, in the case of a media player, shaking the device may cause the device to randomly select a picture or song in group of pictures or songs. Alternatively, shaking the device may cause the device to select the next picture or song in a sequence of songs.

[0138] Other gestures may include translating or rotating the device. Translating the hand-held device (while it is face

up) from side to side may be used to initiate panning or scrolling in the device, or moving the device up and down (while it is face up) may be used to initiate zooming. Rotating the device may be used to cause the device to change modes or states. In some cases, for example, the orientation of the device may correspond to a particular mode. For example, a first mode may be associated with 0 degrees, a second mode may be associated with 90 degrees, a third mode may be associated with 180 degrees and a fourth mode may be associated with 270 degrees. In all these cases, the device can be configured to keep the displayed portion upright as the device is turned. That is, it maintains an upright image no matter what orientation the device is in.

[0139] The 3-D spatial gestures may even be based on more complex motions such as sign language, writing motions, etc.

3. Perform Action Based on Multiple Inputs

[0140] Because the device may have multiple input modes, the hand-held device may be configured to receive simultaneous inputs from different inputs devices, and perform actions based on the multiple simultaneous inputs. The inputs that may be combined to produce new commands may be selected from voice, 2-D touch gestures, 3-D spatial gestures, actuators, etc. For example, this feature may be helpful when making calls via voice selection. A caller may verbalize "TOM," which causes the device to dial "TOM" phone number. If "TOM" has multiple phone numbers, a user may combine the verbal command "TOM" with a 3-D spatial gesture such as shaking to select Tom's second phone number. Various other possibilities will be appreciated by those skilled in the art.

4. Differentiating Between Light and Hard Touches

[0141] As noted above, force sensing in conjunction with touch sensing facilitates two distinct types of interactions, light touches and hard touches. Light touches may be used to perform passive actions such as navigating through content and content manipulation generally without causing a major event to occur. Examples of passive events include moving a cursor, scrolling, panning, etc. Hard touch interactions may be used to select on screen buttons or initiate commands (e.g., causes a significant change to occur).

[0142] FIG. 25 is a diagram of a touch method 400 for implementing this technique. The method 400 begins at block 402 where one or more touches are detected. The touches include not only x any y components but also z components. The x and y components may be supplied by a touch sensing device such as touch screen, touch pad, or touch housing. The z component may be provided by force sensors or display actuators located behind the touch surface of the touch sensing device.

[0143] Following block 402, the method proceeds to block 404 where a determination is made as to whether the touch is a light or hard touch. The determination is generally based on the force or pressure of the touch (z component). For example, if the force of the touch is smaller than a predetermined threshold then the touch is considered a light touch and if the force of the touch is larger than the predetermined threshold then the touch is considered a hard touch. If it is determined that the touch is a light touch, the method proceeds to block 406 where a passive action associated